

The Age at which Science should be Taught.

It must often, I imagine, occur to parents to ask themselves what is the practical result of the years of teaching through which their children have passed, and what they have apprehended and retained of instruction; and, in this interrogation, they naturally recognise that that instruction only is of practical value which enables the learners to retain in their memories certain premises or fixed facts, from which they may make for themselves reasoning and reasonable deductions, not as a matter of repetition, but when they are applied to varying circumstances. It is with reference to this that I shall ask the attention of my readers to the consideration of the subject which I have made the title of this little paper.

I shall, if they will permit me, approach it through the medium of a short story of childish curiosity and of childish intelligence. For on the moral of this story, a moral which is easily discernible, I found the reasonableness of my argument.

"A child, seven years old, one day asked his mother, 'Mamma, what are our bones made of?' 'Of phosphate of lime, my child.'

"What is that?"

"You know what lime is, do you not, that white stuff with which masons work? And you know phosphorus, which forms the heads of matches? Well, when the phosphorus burns, a little white cloud spreads itself in the air, and this is what is called phosphoric acid. Phosphate of lime, then, is composed of lime mixed with burnt phosphorus."

"The child did not answer, but remained in a reverie."

"About two months after this conversation, when the child was walking in the garden one day with his father, he asked him when phosphorus was invented."

"His father explained to him that phosphorus was discovered, not invented, and that it was found in the earth, from which plants absorbed it, and in the bones of animals, who eat either the plants or other animals."

"A gleam of joy shone in the eyes of the child, as he cried—
"Ah! Now I understand."

"What do you mean?" said his father.

"One day mamma told me that we had phosphorus in our bones."

"Well?"

"Well, then, I asked myself how the first men could have had phosphorus in their bones, before it was invented."

We have here a child of only seven years of age, asking questions which, if I may venture to say so, would pose some English parents, and having received reasonable answers, digesting but inefficiently his newly-acquired information, until he was able thoroughly to grasp it in the light of further explanation. And from this I venture to argue that the intelligence of quite a young child is easily captivated by subjects for which, generally speaking, it has a natural receptiveness. The same receptiveness, for example, is not to be expected for the grammatical rules of either our own or of foreign languages. And if a child is to be trained on natural lines, and not on artificial ones, this receptiveness is a very important factor in the training. Let us pursue the subject a little further, and get some more evidence to assist us. Here is what we are told by M. A. de Candelle, *apropos* of the particular study to which he devoted his attention.

"To know how to observe the forms, the colours, the appearances, the qualities, and, above all, the realities of each individual thing, is a talent, the application of which is singularly useful in most careers. Truly, it is only the pure mathematician who can dispense with observation, and even he is not always shut up in his study—he is a man, and ought to know a thousand things outside of his mathematics. In short, the quality of observation is indispensable, so to speak, to every one. In our infancy we are endowed with it in a very remarkable degree."

"What is done afterwards, in our primary and secondary education, in order to develop this precious faculty?"

"Almost nothing."

"What is done, on the contrary, to hinder it, to extinguish it, to subordinate it to other faculties?"

"A very great deal."

"To prove it, I invoke the testimony of those who, like myself, have taught the natural sciences to young people from eighteen to twenty years of age. They will tell you how frequent it is to see good pupils—sometimes the best in the generality of subjects—who do not know how to note the most visible things in a material object. To judge fairly of this, it is sufficient to ask one of them to describe a plant *vivâ voce*. I have known some of them who did not even look at the specimen put into their hands. They seek for information in their head, and, when called upon to observe, they cannot even note whether the leaves are opposite to each other, or whether they are at different heights along the branch.

"At the age of five or six years, they would perhaps have seen better, but during a number of years they have been occupied entirely with internal or abstract matters—grammar, words of different languages, &c. If they had learned any of the facts of natural history, it was from a book. It has been overlooked that the faculty of observation is not only the fact of looking at everything, but of engraving it in the memory, of comparing and of reflecting, in order to draw true conclusions. If many teachers fear this, it is because they do not comprehend it, or are unable to direct in the proper manner."

I will take other testimony, in the same direction, from the Report of the University of Strasburg, 1885, which says:—"Our experience enables us to affirm that a great number of the students in medicine, in spite of a preparation of ten years in celebrated schools, are incapable of seizing rapidly and with precision the most simple phenomena, or of expressing with exactness what they have observed, or of forming with desirable certainty and exactness the judgments and conclusions to which they lead. One sees only too often young men of twenty years of age, whose brains are burdened with humanities, incapable of giving a concise and exact answer to short and clear questions, which every man of good sense, furnished with a good elementary education, comprehends in a moment."

And I think that it would not be difficult to bring further supporting evidence if it were needed. For myself, I can only sorrowfully confess that I have no need for extraneous

witnesses, for it has been my fortune to have traversed, in the discharge of official duties, little known and sometimes absolutely unexplored forest regions, where many objects of interest, alike to the botanist, the naturalist, and the geologist, must have existed, but which were to me sealed books. How gladly would I have exchanged my power of turning English poetry into correctly scanning (I am careful not to say elegant) elegiacs, for the very A B C of science; and it is in deprecation of the displacing of what I may call natural knowledge, and its development in the rising generation, by the insistence upon artificial accomplishments, that I permit myself now to write.

Here, I may say, as one means to an end, that the "*Leçons des Choses*" which our friends on the Continent are more and more developing, might take a prominent, if not a foremost, place in the school teaching of our youngest classes. Boys who are learning to be engineers are now at length being taken over factories and public works as a part of their training—and this is greatly to be commended. But I should like to see the soil broken by preparation at an earlier age. "Go and see chocolate made, and then eat some," would, I take it, be an acceptable, and at the same time a wholesome, prescription for the youngsters, and they might possibly be induced, by the prospect of a prize of more, to write a description of the process of manufacture! Such teaching would go hand in hand with the study of their own language, its spelling and composition, and we shall not have our school inspectors complaining, as they have quite recently done, that poetry is learned by heart, without any attempt at expression, or emphasis, or even distinctness. Questions as to synonyms, they say, are answered, on the whole, readily enough; but the moral of a story is missed, or its bearing misapprehended.

But I have prosed too long, and after all, I am a very one-sided arguer. I will simply hasten to say that I am not condemning, wholesale, instruction as it is now given. I concede with the most absolute heartiness the logical value of simple mathematics, and, indeed, the usefulness of all learning. It is only the sequence, the age at which the different subjects may most profitably be taken up, that I am questioning. Is this the best possible? I think not, and I have given my reasons.

And now I offer, as my forfeit for my prosiness, the

following specimen of official English as she is wrote in our Eastern Empire, not by the average Indian civil servant, but by the too erudite professor of the language:—

"Sir,—I have the honor to report that my office chair has since a long time become quite useless and unfit for me to sit upon. One of the arms is lost, the other one moves about very much, the legs were all moving too, but I got some glue from bazaar and made the equilibrium much more better, so that it was perpendicular. I have been very much brought to the necessity of making this report, as the chair damaged itself more this morning on my seating on it; the rattans all burst within the twinkling of half an eye, and I was within a shorter period of time in a circular form, with my legs touching the top of my desk. I beg to state that my body has received great shock now, and I am rubbing Holloway's ointment to improve the pain. Since I am reporting on office furniture I might also bring to your Honour's notice that the rats in my office are more than troublesome, the new sorting box you had sent me was excavated right through two pigeons hole; if they are allowed to continue in life they certainly will annihilate the office, and I request your favour of sanctioning six annas for a rat trap." The writer was a postal clerk.

GEORGE CADELL.



Parents' Educational Union.

BY DOROTHEA BEALE, PRINCIPAL OF THE LADIES' COLLEGE, CHELTENHAM.

And glorious Hector took the helmet off,
And laid it gleaming on the ground, and kissed
His darling child, and danced him in his arms,
And spoke in prayer to Zeus and all the gods:
"Zeus, and ye other gods, oh grant that this
My child, like me, may grow a champion here—
As good in strength, and rule with might in Troy,
That men may say, 'The boy is better far
Than was his sire.'"

Trans. by KINGSLEY.

What right have we teachers in a Parents' Educational Union? Are we so bent on teaching that we cannot be content with the children, but want to gather in parents also?

Ah, no! It is not as teachers and learners that we would meet; but as fellow-workers, as friends, that together we may learn from and with one another, how we may best carry forward that which is the supreme work of woman, and, in dying, leave as witnesses that we have lived, men and women, stronger in body, abler in mind, nobler in character, than we have been—that in each age of the world, the wish of the true man may be fulfilled, and the upward progress of humanity be realised—of which the earliest Scriptures spoke, when they said that man was created in the image of God, that he might grow into His likeness; and of which the latest speak, when they tell of man's comprehending the love of God which passeth knowledge, and of being filled with the fulness of God.

Now what is it that parents and teachers will respectively contribute? Well, I think this will generally be the division of labour. Parents will contribute those minute observations which must precede the recognition of law, and form the basis of